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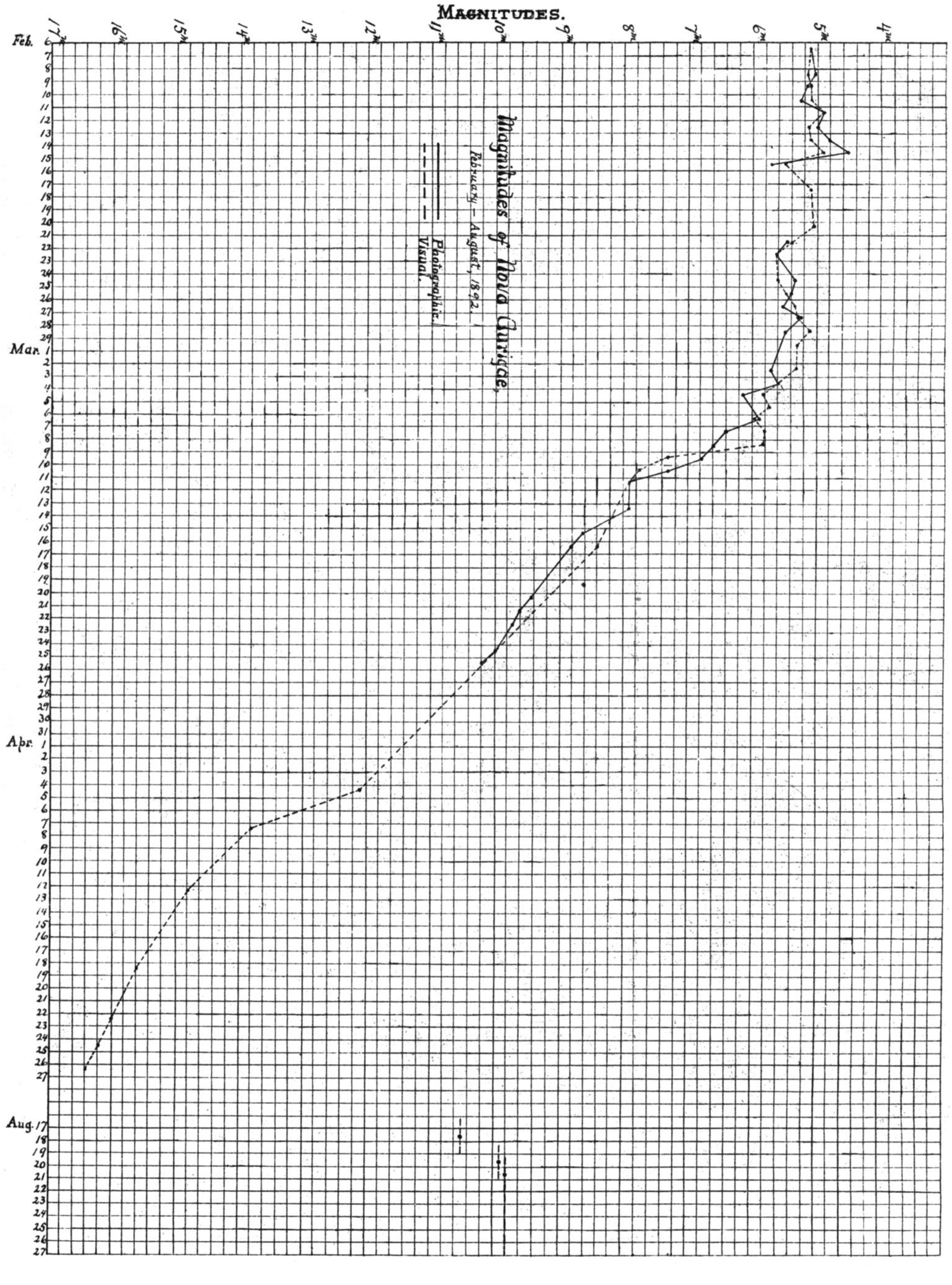

VISUAL MAGNITUDES OF *NOVA AURIGÆ.*—OBSERVATIONS MADE AT MT. HAMILTON.

The visual magnitudes of *Nova Aurigæ* were carefully observed at Mt. Hamilton. The comparison stars employed were the following:

	D M.	α 1855.0	δ 1855.0	Mag.	Pickering's Star.
a	+32° 1024	$5^h\ 23^m\ 18.4^s$	+32° 4.8′	5.0	*b*
b	+30 963	5 29 19.6	+30 23.9	5.6	
c	+30 898	5 17 51.4	+30 4.2	5.8	*e*
d	+29 909	5 20 27.9	+29 3.9	[7.0]	*g*
e	+29 911	5 20 52.4	+29 25.6	[7.5]	
f	+30 912	5 20 27.2	+30 28.4	[8.5]	*n*
g	+30 920	5 22 6.3	+30 35.1	[9.5]	
h		5 22 43.8	+30 21.1	[10.4]	*s*
i		5 22 50.9	+30 18.2	[10.6]	
j		5 22 44.2	+30 17.5	[11.8]	
k		5 22 42.8	+30 20.0	[14.8]	

The magnitudes of stars *a*, *b* and *c* are those of the *Harvard Photometry;* those of *d*, *e*, *f* and *g* are taken from the *Bonn Durchmusterung;* those of *h*, *i*, *j* and *k* are the estimates made by Mr. BURNHAM.* Accurate photometric determinations of the last eight magnitudes, enclosed in brackets, will probably change them considerably, and likewise the resulting magnitudes of the *Nova*.

At first each observer made only one estimate per night; but later, when it was noticed that the brightness sometimes fluctuated rapidly, two or more estimates were often made the same evening. The observations from February 6 to March 16 inclusive are given in the table below. The first column contains the Pacific standard times of observation. The second and fourth columns contain the comparisons of *Nova* with the other stars as made by observers J. M. SCHAEBERLE and W. W. CAMPBELL. The third and fifth columns give the resulting magnitudes of *Nova*. In the last column the estimates made with the eye and with the opera glasses are denoted respectively by E. and O. G.

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* See *Monthly Notices R. A. S.* for April, 1892.

Pac. S. T.	J. M. S.	Mag.	W. W. C.	Mag.	Remarks.
1892	*Nova.*		*Nova.*		
Feb'y 6^d.417	=or>*a*	5.0±	0.15<*a*	5.15	E. and O. G.
8.375			0.15<*a*	5.15	E. and O. G.
9.437			0.1 <*a*	5.1	E. and O. G.
10.396			0.1 <*a*	5.1	E.
11.312	0.1 >*a*	4.9	0.1 >*a*	4.9	E.
12.458	0.2 <*a*	5.2	0.15<*a*	5.15	E. and O. G.
13.458	0.1 <*a*	5.1	0.1 <*a*	5.1	E. and O. G.
14.312	0.1 >*a*	4.9			E.
14.375			0.1 >*a*	4.9	E.
15.292	0.65<*a*	5.65			E. and O. G.
15.312			0.3 <*a*	5.3	O. G. "Fainter than ever seen before."
15.458			0.05>*b*	5.55	E. and O. G.
17.302			0.25<*a*	5.25	E.
17.437	0.05<*a*	5.05	=*a*	5.0	E. and O. G.
20.312	=*a*	5.0	0.1 <*a*	5.1	O. G. Through thin fog.
21.333			0.35<*a*	5.35	E.
21.333			0.2 >*b*	5.4	E.
21.555	0.3 <*a*	5.3	0.4 <*a*	5.4	E. and O. G.
21.555			0.1 >*b*	5.5	E. and O. G.
22.333			0.1 <*b*	5.7	O. G.
22.437	0.05<*b*	5.65	0.05<*b*	5.65	O. G.
24.302	0.05<*b*	5.65	0.1 <*b*	5.7	O. G.
24.437	0.05>*b*	5.55	=*b*	5.6	O. G.
25.396	0.1 >*b*	5.5	0.1 >*b*	5.5	O. G.
25.521	0.2 >*b*	5.4			O. G.
26.292	0.15>*b*	5.45	=*b*	5.6	O. G.
26.396	0.25>*b*	5.35	0.2 >*b*	5.4	O. G.
26.542	0.3 >*b*	5.3			O. G.
27.333			0.3 <*a*	5.3	O. G.
27.333			0.3 >*b*	5.3	O. G.
28.375	0.05<*a*	5.05	0.15<*a*	5.15	E. and O. G.
29.479	0.25<*a*	5.25	0.3 <*a*	5.3	E. Clouds interfere.
March 2.364	0.25<*a*	5.25	0.35<*a*	5.35	E.
2.364			0.25>*b*	5.35	E.
3.532			=*b*	5.6	E. Clouds interfere.
4.302	0.15<*b*	5.75	0.3 <*b*	5.9	O. G.
4.302			0.1 <*c*	5.9	O. G.

Pac. S. T.	J. M. S.	Mag.	W. W. C.	Mag.	Remarks.
1892	*Nova.*		*Nova.*		
March 5.312	$= b$	5.6			O. G.
5.396			$0.2 < b$	5.8	O. G.
5.396			$= c$	5.8	O. G.
6.292	$0.4 < b$	6.0	$0.3 < b$	5.9	O. G.
6.292	$0.05 > d$		$0.1 < c$	5.9	O. G.
7.437	$0.05 < c$	5.85	$= c$	5.8	O. G.
8.312			$0.05 < c$	5.85	E.
9.333	$0.3 < d$	[7.3]	$0.2 < d$	[7.2]	O. G.
9.333	$0.05 > e$	[7.45]			O. G.
10.333	$0.2 < e$	[7.7]	$0.3 < e$	[7.8]	O. G.
11.333	$0.3 < e$	[7.8]			6-inch equatorial
11.333			$0.45 < e$	[7.95]	O. G.
16.396	$0.1 > f$	[8.4]	$0.1 > f$	[8.4]	6-inch equatorial

Thereafter the observations were made with the 36-inch telescope. In April *Nova* was compared with the stars *j* and *k*. The light interval between *j* and *k* was divided into ten grades, 10 at *j* and 0 at *k*, and the brightness of *Nova* estimated on that scale. Since the re-appearance of *Nova* in August the brightness has been compared in a similar manner with *g*, *h* and *i*. The observations are given below.

Pac. S. T.	*j*	*Nova.*	*k*	Observer.
1892—April $4^{\rm d}.333$	10	10	0	J. M. S.
4.333	10	9	0	W. W. C.
4.361	10	8	0	E. S. H.
7.344	10	2	0	E. S. H.
7.344	10	1	0	J. M. S.
7.344	10	5	0	W. W. C.
12.364	10	1	0	E. S. H.
12.364	10	—1	0	J. M. S.
12.364	10	—1	0	W. W. C.
18.333	10	—1	0	E. S. H.
18.333	10	—3.5	0	J. M. S.
18.333	10	—3	0	W. W. C.
22.340	10	—6	0	E. S. H.
24.375	10	—7	0	W. W. C.
26.380	10	—9	0	E. S. H.

NOTES.

1892, April 4.—Seeing poor. *Nova* was suspected to be nebulous, though the image was too unsteady to decide, and the following notes were made:

"*Nova* is somewhat nebulous." E. S. H.

"*Nova* seems to be fuzzy at times. Is it in focus when the other stars are?" J. M. S., W. W. C.

1892, April 7.—Seeing good.

1892, April 12.—Sky hazy, but observations good.

1892, April 18.—Seeing good.

1892, April 22.—Seeing good.

1892, April 24.—Sky hazy, and observations only fair.

"*Nova* not seen all the time. Not brighter than ⅓*k*." E. S. H.

"*Nova* nearly on limit of vision." W. W. C.

1892, April 26.—Seeing good, but altitude of *Nova* is small.

"The estimate is extremely uncertain." E. S. H.

"Only an occasional glimpse of it. Probably two magnitudes greater than *k*." W. W. C.

Further attempts to observe *Nova* were prevented by a three weeks' storm, at the close of which the star was too near the sun to be observed. The rapid decline in brightness, however, indicated that it would pass beyond the power of the telescope in a few days after our last observation.

On August 17 we directed the telescope to the region of *Nova* to determine whether any trace of it remained, and were surprised to find its position occupied by a bright star. "Looking at *Nova* with powers 350 and 700, it is seen to lack the sharpness of the other stars of equal brightness. Moonlight interferes."

Dividing the light interval between the comparison stars *h* and *i* into ten grades, as before, the following estimates were made, with the eye-piece in the ordinary stellar focus:

Pac. S. T.	*h*	*Nova*	*i*	Observer.
1892, Aug. $17^{d}.630$	10	9	0	E. S. H.
17.630	10	9	0	J. M. S.
17.630	10	8	0	W. W. C.

According to these estimates *Nova* was about 10.5 magnitude.

When the eye-piece was focused on the *Nova*, Professor HOLDEN observed that *Nova* was slightly brighter than the star *h*.

The following estimates were made with the 12-inch telescope:

Pac. S. T.	g	*Nova*	h	Observer.
1892, Aug. $19^{d}.604$	10	5	0	W. W. C.
19.604	10	7	0	S. D. Townley.

According to these estimates the magnitude of *Nova* was about 9.8.

With the 4-inch finder of the great telescope Mr. CAMPBELL has compared *Nova* with the stars g and h on several mornings, with the practically constant result, $g = 10$, *Nova* = 7, $h = 0$.

In the accompanying illustration the visual magnitudes are represented by the system of points connected by the dotted lines. The times of observation are shown at the side of page, and the corresponding magnitudes at the end. The points should really be connected by a continuously curved line, instead of by a broken line; but to draw such a curve would require a practically continuous series of observations. The portion of the diagram corresponding to observations made after March 8 is only roughly approximate, since it is based upon merely provisional magnitudes of the last eight comparison stars; and, as stated before, these will probably be considerably changed by the photometric determinations. The estimates of *Nova's* magnitude made in August, recorded in the preceding paragraphs, are plotted near the right end of the diagram.

The points connected by the full lines represent the photographic magnitudes of *Nova* obtained by Professor SCHAEBERLE, the details of which are published in full in the *Astronomical Journal*, No. 269.

The magnitude of *Nova* since its re-appearance has been variously estimated, here and elsewhere, from 9.2 to 10.6. It is not improbable that some variation in brightness has occurred. But the different estimates made by different observers, and by the same observer with different instruments, are explained in part by the fact that the *Nova* is now a planetary nebula. Nearly all of its light falls in the spectrum at wave-lengths 5003 and 4954, and the apparent magnitude of an object with light peculiarly distributed is a function of the focusing and the color curve of the objective. In small telescopes the images of the nebula and of the comparison star are practically in focus at the same time. In the great telescope the focus for nebular rays is about 0.3 inch further from the object-glass than the stellar focus. While the ratio of the light of the nebula to that of the star remains the same, yet with the eye-piece adjusted to the stellar focus the small nebula will, in general, appear relatively brighter in a small telescope than in a large one.

NOTE.—Observations of *Nova* were made abroad nearly a week before the telegraphic announcement of the discovery reached Mt. Hamilton. In order that our readers may have a record of the magnitudes beginning with the date of discovery, we append the observations made at Edinburgh by Dr. COPELAND, Astronomer Royal for Scotland, on the first six days of February:

Greenwich M. T.	Magnitude.
1892, Feb. 1^d 6^h	5.56
2 8	5.56
3 9	5.13
4 8	5.0
5 8.5	4.65
6 7	4.55

Fortunately, also, we have a fairly satisfactory record of *Nova's* magnitude before the date of its discovery. On December 8, 1892, Dr. WOLF, of Heidelberg, took a photograph of this region of the sky, which shows all the stars down to the 9th magnitude, but the *Nova* is not shown on this plate. Between December 10 and February 1 thirteen photographs of this region had been taken at the Harvard College Observatory for other purposes, on all of which the *Nova* is recorded. The list, as given by Professor PICKERING, is:

Date.	Magnitude of *Nova*.
1891, Dec. 10	5.37
11	5.33
13	5.22
17	4.67
18 18	4.46
28	4.55
30	4.60
1892, Jan. 5	4.58
8	4.72
9	4.67
16	4.96
20	5.23